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FEDERAL - STATE - PRIVATE

COOPERATIVE

SNOW SURVEY and WATER SUPPLY FORECASTS for ARIZONA

UNITED STATES DEPARTMENT of AGRICULTURE...SOIL CONSERVATION SERVICE,

SALT RIVER VALLEY WATER USERS ASSOCIATION

and

ARIZONA AGRICULTURAL EXPERIMENT STATION

Data included in this report were obtained by the agencies named above in cooperation with the Federal, State and private organizations listed on the last page of this report.

MAR. 1, 1960

UNITED STATES DEPARTMENT OF AGRICULTURE - SOIL CONSERVATION SERVICE

TO RECIPIENTS OF COOPERATIVE SNOW SURVEY AND WATER SUPPLY FORECAST REPORTS:

The climate of the cultivated and populated areas of the West is characterized by relatively dry summer months. Such precipitation as occurs falls mostly in the winter and early spring months when it is of little immediate benefit to growing crops. Fortunately, most of this precipitation falls as mountain snow which stays on the ground for months, melting later to sustain streamflow during the period of greatest demand during late spring and summer. Thus, nature provides in mountain snow an imposing water storage facility.

The amount of water stored in mountain snow varies from place to place as well as from year to year and accordingly, so does the runoff of the streams. The best seasonal management of variable western water supplies results from fore-knowledge of the runoff.

A snow survey consists of a series of about ten samples taken with specially designed snow sampling equipment along a permanently marked line, about 1000 feet in length, called a snow course. The use of snow sampling equipment provides snow depth and water equivalent values for each sampling point. The average of these values is reported as the snow survey measurement for a snow course.

Snow surveys are made monthly or semi-monthly beginning in January or February and continue through the snow season until April, May or June. Currently more than 1400 western snow courses are measured each year. These measurements furnish the key data for water supply forecasts.

By relating snow survey measurements taken over a period of years to spring-summer runoff during the same period, relationships have been developed which make it possible to forecast seasonal runoff several months in advance of occurrence. In order to make a forecast, once a forecast relationship has been developed, the maximum snow water content at previously selected key snow courses is usually entered in the forecast relationship. More accurate forecasts are often obtained when other factors such as soil moisture, base flow and spring precipitation are considered and included in the forecast relationships.

Listed below are the Federal-State-Private Cooperative Snow Survey and Water Supply Forecast reports available for the West which contain detailed information on snow survey measurements, streamflow forecasts, reservoir storage, soil moisture and other guide data to water management and conservation decisions.

PUBLISHED BY SOIL CONSERVATION SERVICE

REPORTS	ISSUED	LOCATION	COOPERATING WITH
RIVER BASINS			
COLORADO AND STATE OF UTAH	_MONTHLY (JANMAY)	SALT LAKE CITY. UTAH	UTAH STATE ENGINEER AND OTHER AGENCIES
COLUMBIA AND STATES OF	MONTHLY (JANMAY)	BOISE, IDAHO	IDAHO STATE RECLAMATION ENGINEER
UPPER MISSOURI AND STATE OF MONTANA	MONTHLY (FEBMAY)	BOZEMAN, MONTANA	MONT. AGR. EXP. STATION
WEST-WIDE	OCT. 1. APR. 1. MAY 1	PORTLAND. OREGON	ALL COOPERATORS
STATES			
ARIZONA	SEMI-MONTHLY	PHOENIX, ARIZONA	SALT R. VALLEY WATER USERS ASSOCIATION ARIZ. AGR. EXP. STATION
COLORADO AND NEW MEXICO	MONTHLY (FEBMAY)		COLO. AGR. EXP. STATION COLO. STATE ENGINEER N. MEX. STATE ENGINEER
NEVADA ———————————————————————————————————	MONTHLY (FEBAPR.)	RENO, NEVADA —————	NEVADA DEPT. OF CONSERVATION AND NATURAL RESOURCES - DIVISION OF WATER RESOURCES
OREGON	MONTHLY (JANMAY)	PORTLAND. OREGON	ORE. AGR. EXP. STATION OREGON STATE ENGINEER
WASHINGTON	MONTHLY (FEBMAY)	SPOKANE. WASHINGTON	WASH, STATE DEPT. OF CONSERVATION
WYOMING	MONTHLY (FEB JUNE)	CASPER, WYOMING	WYOMING STATE ENGINEER
Copies of these various	reports may be secured	from: Head, Water Supp Soil Conservation 209 S. W. Fifth	
	PUBLISHED BY OT	THER AGENCIES	
REPORT	ISSUED	A	GENCY
BRITISH COLUMBIA	. MONTHLY (FEBJUNE)		R RIGHTS BR., DEPT. OF LANDS IAMENT BLDG., VICTORIA, B.C.,
CALIFORNIA	MONTHLY (FEB MAY)	CALIFORNIA DEPT. C	OF WATER RESOURCES. SACRAMENTS.

FEDERAL-STATE COOPERATIVE SNOW SURVEYS AND WATER SUPPLY FORECASTS

for

ARIZONA

(Salt, Verde, Gila and Part of Lower Colorado River Basin)

Issued

March 2, 1960

Report Prepared

by

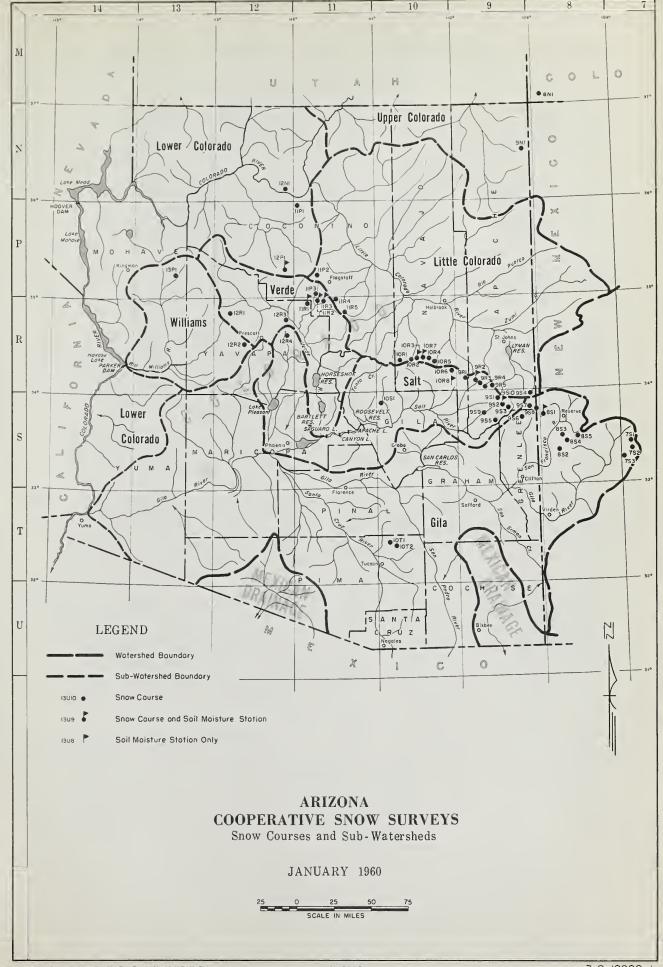
Richard W. Enz, Acting Snow Survey Supervisor
Soil Conservation Service
Post Office Box 929
Phoenix, Arizona

Issued by

Robert V. Boyle State Conservationist Soil Conservation Service

Victor I. Corbell
President
Salt River Valley Waters Users' Ass'n.





INDEX to SNOW COURSES and SOIL MOISTURE STATIONS

NUMBER 治治	NAME	SEC	TWP	RGE ***	ELEVATION	RIVER BASIN
11P3	Antelope Park	29	19N	8E	7300	VerdeDiscontinued Salt-Little Colorado Gila
9S1	Baldy (p)	28	7N	27E	9125	
10T1	Bear Wallow	6	12S	16E	8100	
9S6	Beaver Head	13	LN	30E	8000	
950 953	Big Lake Knoll	2	5n	28E	8800	Salt-Frisco Salt-Frisco-Little Colorado Discontinued
7S3 9S10=* 12N1	Black Canyon Black River Divid Bright Angel	34	13S 6N 33N	11W**** 27E 3E	6790 9100 8400	GilaDiscontinued Salt-Little Colorado Lower Colorado
12R1 10R3-M	Camp Wood Canyon Creek	3 18	16N 1 1 N	6W 15E	5700 7500	Williams-Verde Salt-Little ColoradoReplaced by 10R7-M
10R7-M 11R2-M 12P1-M	Canyon Creek #2 Casner Park Chalender	18 19 27	11N 18N 22N	15E 8E 3E	7500 6930 7100 § 6000	Salt-Little Colorado Verde Verde
10R8 -* 9S9	Corduroy Creek Corn Creek (p)			g.110°08'W. g.109°45'W.	§ 7730	Salt Not Read
8s3 9s7	Corner Mountain Coronado Trail Elk	7 26	10S 5N	17W**** 30E 14E	8850 8000 7 600	Gila-Frisco Not Read Salt-Frisco
10R2 10R6 11P2	Forest Dale Fort Valley	31 2 22	11N 9N 22N	21E 6E	6430 7350	Salt-Little ColoradoDiscontinued Salt-Little Colorado Verde-Little Colorado
9R5	Ft. Apache	18	7n	27E	9160	Salt-Little Colorado Frisco-Gila
8S1-M	Frisco Divide	31	6s	20W****	8000	
12R4	Gaddes Canyon	11	15n	2E	7600	
10R5 11P1	Gentry Grand Canyon	36 21	11N 30N	15E 4E	7600 7600 7500	Verde-Agua Fria Salt Lower Colorado
11R5	Happy Jack	30	17N	9E	7630	Verde
10R4	Heber (p)	28	11N	1 5E	7 600	Salt-Little Colorado
7S2	Inman	6	11S	10W****	7800	Gila
12R2	Iron Springs	22	14n	3W	6200	Williams-Verde
9S2	Maverick Fork (p)	13	6n	27E	9050	Salt
9R4	McKay Peak	13	7n	2 4E	8250	Salt Not Read
9R2≕M	McNary	14	8n	23E	7200	Salt-Little Colorado
9R1	Milk Ranch	28	8n	23E	7000	Salt
12R3	Mingus Mountain	3 2	15N	2E	7100	Verde-Agua Fria
8S2	Mogollon		11S	19W****	7000	Frisco-Gila
11R4	Mormon Lake	13	18N	8E	7350	Verde-Little Colorado
11R3-M	Mormon Mountain	14	18N	8E	7500	Verde
11R1 - M	Munds Park	7	18n	7E	6500	Verde Gila Not Read Gila Not Read
8S4	N-Bar Lake	16	10s	17W****	8600	
8S5	Negrito	6	10s	16W****	8200	
984	Nutrioso	23	6N	30E	8500	Salt-Frisco-Little Colorado
985	Pacheta	At Town	of Maver	ick, Ariz.	§ 7800	Salt
9N1	Roof Butte	15	8n	6W*****	8500	Little Colorado Not Read
10T2	Rose Canyon	15	12s	16E	7300	Gila
9S8	State Line	6	6s	21W****	8000	Gila-Frisco
7S1	Taylor Creek	20	10S	10W****	7850	Gila
9R3	Trout Creek		7N	24E	6400	Salt Not Read
8N1 13P1 10R1	Washington Pass Willow Ranch Woods Canyon	16 15	'05'N. Lo 21N 11N	ng.108 ⁰ 50'W 11W 13E	§ 8600 5000 7640	Little ColoradoNot Read Williams Salt-Little Colorado
1081	Workman Creek	33	6N	14E	6900	Discontinued Salt

^{*} SOIL MOISTURE STATION ONLY

*** NEW MEXICO PRINCIPAL MERICIAN

₩₩₩₩ NAVAJO BASE

 $[\]ensuremath{\mathcal{H}}\xspace$ Number indicates Location of snow course within coordinate rectangle, thus 9N1 is Course #1 in coordinate rectangle 9N.

^{***} ALL IN GILA AND SALT RIVER BASE AND MERIDIAN EXCEPT WHERE OTHERWISE INDICATED.

 $^{{\}tt M}$ - Soil Moisture Station installed on or in vicinity of snow course.

⁹ UNSURVEYED

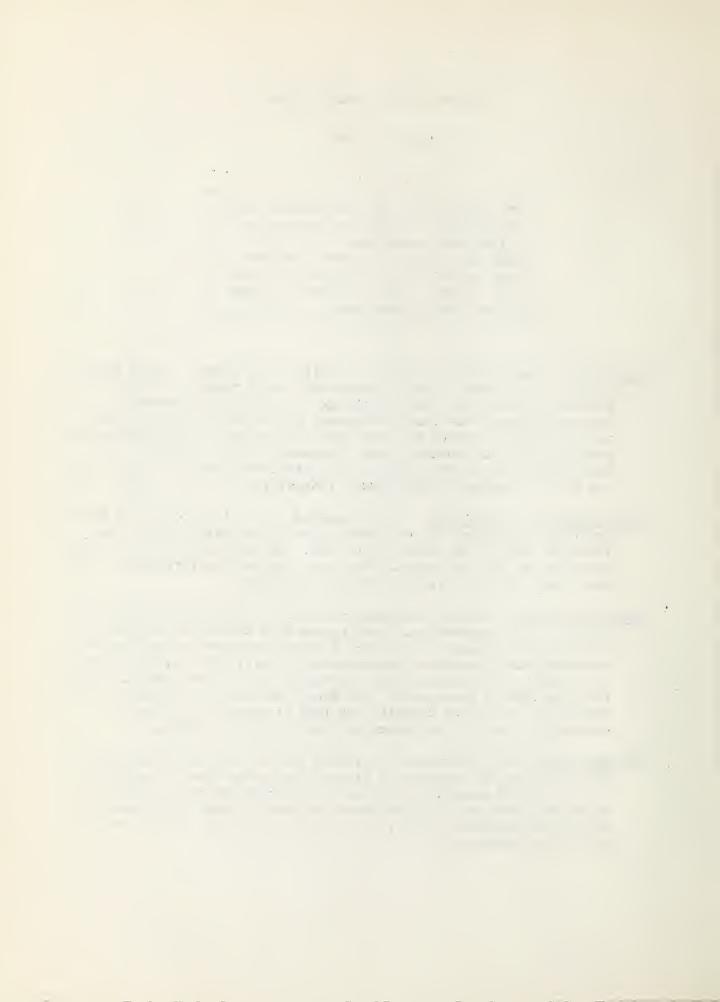
⁽p) STORAGE GAGE INSTALLED ON OR IN VICINITY OF SNOW COURSE.

ARTZONA WATER SUPPLY OUTLOOK

March 1, 1960

- SNOW COVER: Normally the snow pack is declining by March 1. This year, however, snow cover is still increasing. As a result, although the increase is not great, the percentage of average is substantial. The snow courses were read on February 29, or shortly before that, and consequently missed the snow that fell March 1. This additional precipitation has, however, been considered in the forecast. The snow pack on the Verde, Salt and Gila River watersheds is 131%, 257% and 281% of average for this date, respectively.
- STREAM FLOW AND WATER SUPPLY: The forecasted stream flow for March through May is 108% of normal on the Verde, 176% on the Salt, 200% on the Tonto and 246% on the Upper Gila River. The Little Colorado is forecasted to be 268% of normal. The total stream flow forecasted to the Salt River Valley Project is 545,000 acre feet.
- RESERVOIR STORAGE: Reservoir storage continued to increase slowly up to March 1. Cold weather and light storms have caused the stream flow to be low in February. The March 1 storm which covered most of the watershed should produce some immediate runoff. The total storage for the 8 major reservoirs serving central Arizona is now 1,700,200 acre feet, or 186% of average for this date. The Salt River Valley Project reservoirs are 70% of capacity and 184% of average. San Carlos Reservoir is only 17% of capacity, but is 206% of average.
- SOIL MOISTURE: Soil moisture is very good for the production of runoff.

 The soil moisture stations at higher elevations show the soil profile to be at field capacity or higher. The recent storm has helped to bring the lower areas of the watershed back to near field capacity. Future March storms should produce very good runoff if they are of sufficient magnitude.



STREAM FLOW FORECASTS - MARCH 1, 1960

The following summarized runoff forecasts are based principally on mountain snow cover and on the assumption that precipitation and temperature will be near average from the present time to the end of the forecast period. Appreciable deviations from normal of temperature and/or precipitation will correspondingly modify these forecasts.

	SEASONAL STREAM FLOW IN THOUSANDS OF ACR FORECAST PERIOD MARCH - MAY INCLUS						
SUB-WATERSHED, STREAM and STATION	Forecast Runoff 1960	Percent 15-Year Average	Mea 1959	sured R	unoff 1957	1943-57 Average	
Salt River at Intake	360.0	176	36.3	527.4	114.2	200.4	
Tonto River above Roosevelt	50.0	200	3.3	71.7	11.4	25.0	
Verde River above Horseshoe	135.0	108	38.7	245.2	59.0	124.9	
Gila River at Virden	65.0	235	7.0	144.9	8.6	27.6	
Frisco River at Clifton	65.0	257	7.4	186.2	12.4	25.3	
Little Colorado River above Lyman Dam*	15.0	268	0.7	21.5	1.3	5.6	

^{*}Forecast period for Little Colorado River above Lyman Dam is for March-June, inclusive.



STATUS OF ARIZONA RESERVOIR STORAGE - MARCH 1, 1960

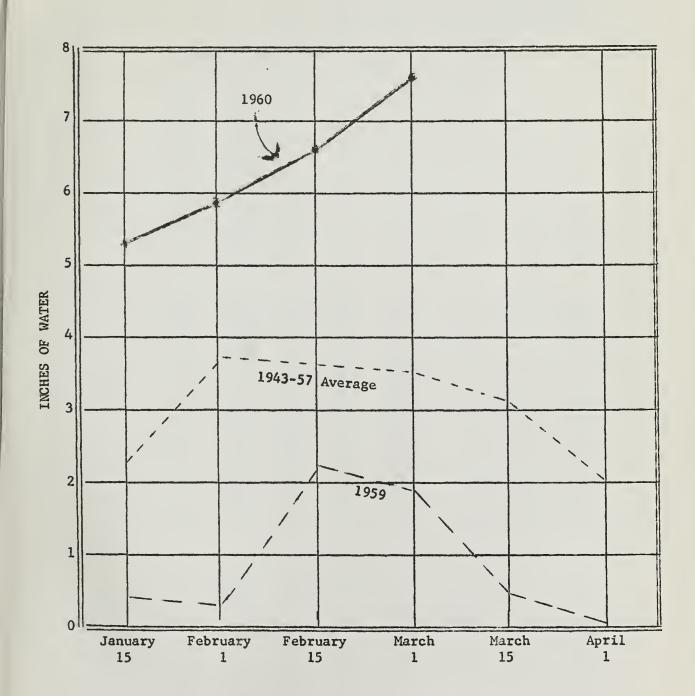
SUB-		USABLE	USABLE	STORAGE -	1000s ACR	
WATERSHED and/or STREAM	RESERVOIR	CAPACITY 1000s AC. FT.	1960	1959	1958	15-Year Average 1943-57
GILA RIVER SUB-WATERSHED						
Agua Fria	Lake Pleasant	163.8	48.7	18.5	12.7	24.9
Gila	San Carlos	1,205.0	205.9	107.9	63.6	102.2
Verde	Bartlett	180.0	121.6	97.4	139.4	54.4
Verde	Horseshoe	143.0	124.3	25.5	12.8	16.8*
Salt	Roosevelt	1,381.6	834.1	450.6	56.0	432.8
Salt	Apache	245.1	238.8	238.3	232.2	203.5
Salt	Canyon	57.9	57.8	57.0	52.6	42.4
Salt	Saguaro	69.8	69.0	64.1	63.6	38.5
	LOW	ER COLORADO	RIVER SUB-W	ATERSHED		
Colorado	Lake Havasu	619.4	549.9	549.0	532.8	602.6
Colorado	Lake Mohave	1,810.0	1,728.2	1,700.0	1,743.0	1,467.0*
Colorado	Lake Mead	27,207.0	19,124.0	21,194.0	19,712.0	16,929.0
Little Colorado	Lyman	30.6	10.5	18.7	8.5	6.3
Little Colorado	Show Low Lake	5.1	4.8	0.1	0.2	
	,					

^{*}Average is for less than 15 years of record in the 1943-57 period.

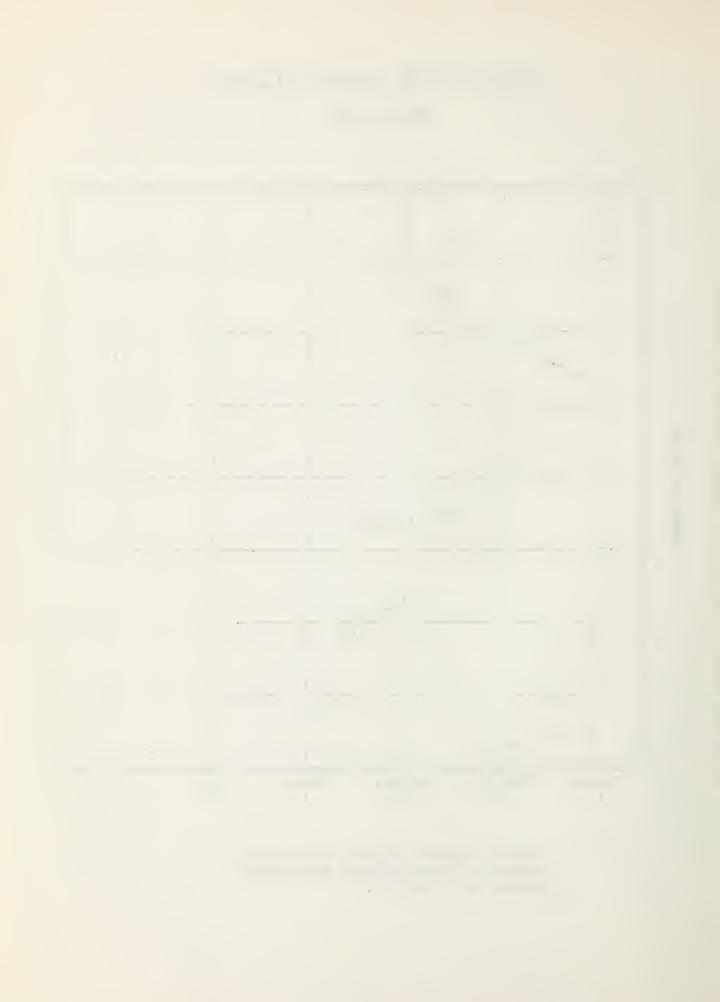
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RELATIVE SNOW WATER ACCUMULATION IN ARIZONA

March 1, 1960



This graph represents the average snow water content on eleven selected snow courses on Arizona Sub-Watersheds.



			SNOW COVER MEASUREMENTS							
			1960							
SUB-WATERSHED			Date	Snow	Water	Water	Conte	nt (In.)	Prior	
and			of		Content			1943-57	Yrs. of	
SNOW COURSE	No.	Elev.	Survey	(In.)	(In.)	1959	1958	Average	Record	
077 A D.T.I.D.D.										
GILA RIVER										
Nutrioso	984	8500	2/29	12	3.8	T	0.7	1.7	22	
Bear Wallow	10T1	8100	2/29	31	10.7	1.2	1.8	2.6**	12	
Frisco Divide	8S1-M	8000	2/29	14	4.7	0.9	2.4	1.7	22	
State Line	988	8000	2/29	20	5.4	0.4	1.2	2.1	22	
Coronado Trail	9S7	8000	2/29	18	4.7	T	0.9	2.3	22	
Beaver Head	986	8000	2/29	26	6.3	T	1.1	2.3	21	
Taylor Creek	781	7850	2/29	T	T	0.0	0.5	0.4	17	
Inman	752	7800	2/29	3	0.4	0.0	0.5	0.5**	13	
Rose Canyon	10T2	7300	2/29	16	5.8	0.0	0.6	0.7**	12	
Mogollon	8\$2	7000	2/29	12	3.2	T	1.6	1.3**	7	
SALT RIVER										
Ft. Apache *	9R5	9160	2/27	40	12.3	4.6	6.8	6.8**	9	
Baldy *	981	9125	2/27	37	11.8	2.8	7.7	5.9**	10	
Maverick Fork	9S 2	9050	2/27	41	12.7	2.3	9.6	7.5**	9	
Nutrioso	984	8500	2/29	12	3.8	T	0.7	1.7	22	
Coronado Trail	987	8000	2/29	18	4.7	Ī	0.9	2.3	22	
Beaver Head	986	8000	2/29	26	~6.3	Ť	1.1	2.3	21	
Pacheta	985	7800	2/29	24	5.0	0.0	2.0	2.4**	9	
Gentry	10R5	7600	2/28	24	8.0	2.9	0.8	2.4**	8	
Heber	10R4	7600	2/28	27	9.0	2.4	0.7	2.4**	9	
Canyon Creek #2	10R7-M	7500	2/28	28	8.7	2.3	0.6		2	
McNary	9R2-M	7200	2/29	24	7.7	0.8	T	2.4	21	
Milk Ranch	9R1	7000	2/29	14	4.5	0.0	T	0.9	19	
Workman Creek	1051	6900	2/23	28	10.4	1.9	0.9	1.5**	8	
Forest Dale	10R6	6430	2/29	9	2.7	0.3	0.0	1.0	21	
VERDE RIVER										
Happy Jack	11R5	7630	Report	Dol ass	ođ	T	T	2.6**	8	
Gaddes Canyon	12R4	7600	2/29	37	9.4	5.2	1,9	2.7**	6	
Mormon Mountain	11R3-M	7500	2/29	36	9.6	2.9	1.6	4.6**	10	
Mormon Lake*	11R4	7350	2/29	27	7.5	2.1	0.8	4.9**	13	
Fort Valley*	11P2	7350	2/29	21	5.6	2.7	0.3	2.3**	13	
Mingus Mountain	12R3	7100	2/29	12	2.5	1.7	T	1.1**	13	
Chalender	12P1-M	7100	2/29	25	6.1	3.4	T	2.8**	13	
Casner Park	11R2-M	6930	2/29	28	7.5	2.3	T	2.2**	9	
Munds Park	11R1-M	6500	2/29	21	5.4	1.7	T	1.6%	9	
Iron Springs*	12R2	6200	2/25	T	7.4 T	0.0	T	1.2%	14	
Camp Wood	12R1	5700	Report			2.5	0.0	0.8**	14	
		3,00	Kebarr	Delay	eu	200	3.0			

^{*} On Adjacent Drainage.

^{**} Average is for less than 15 years of record in the base period.



ARIZONA SNOW SURVEYS - ABOUT MARCH 1, 1960

			SNOW COVER MEASUREMENTS						
		1960		PAST RECORD					
SUB-WATERSHED			Date	Snow	Water	Water	Conte	nt (In.)	Prior
and			of	Depth	Content			1943-57	Yrs. of
SNOW COURSE	No.	Elev.	Survey	(In.)	(In.)	1959	1958	Average	Record
WILLIAMS RIVER									
Iron Springs	12R2	6200	2/25	T	T	0.0	T	1.2**	14
Camp Wood*	12E1	5700	Report	Delay	ed	2.5	0.0	**8,0	14
Willow Ranch	13P1	5000	2/28	T	T		0.0	0.5**	9
LOWER COLORADO RI	<u>LVER</u>								
Bright Angel	12N1	8400	No Sur	vev			6.7	9.4**	12
Grand Canyon	11P1	7500	2/29	21	4.6	1.8	0.5	2,1**	13
Fort Valley	11P2	7350	2/29	21	5.6	2.7	0.3	2.3**	13
Chalender *	12P1-M	7100	2/29	25	6.1	3.4	T	2.8**	13
LITTLE COLORADO H	RIVER								
Ft. Apache	9R5	9160	2/27	40	12.3	4.6	6.8	6.8**	9
Baldy	951	9125	2/27	37	11.8	2.8	7.7	5.9**	10
Nutrioso	984	8500	2/29	12	3.8	T	0.7	1.7	22
Happy Jack*	11R5	7630	Report	Delay	ed	T	T	2.6**	8
Gentry	10R5	7600	2/28	24	8.0	2.9	0.8	2.4**	8
Heber	10R4	7600	2/28	27	9.0	2.4	0.7	2.4**	9
Canyon Creek #2	10R7-M	7500	2/28	28	8.7	2.3	0.6		2
Mormon Mountain	11R3-M	7500	2/29	36	9.6	2.9	1.6	4.6**	10
Mormon Lake	11R4	7350	2/29	27	7.5	2.1	0.8	4.9**	13
Fort Valley	11P2	7350	2/29	21	5.6	2.7	0.3	2.3**	13
McNary	9R2-M	7200	2/29	24	7.7	0.8	T	2.4	21
Forest Dale	10R6	6430	2/29	9	2.7	0.3	0.0	1.0	21

^{*}On Adjacent Drainage.

DEL	AYED REPOR	TS RECE	IVED SI	NCE LA	ST BULLET	rin - Februa	ARY 15, 1960
VERDE RIVER Camp Wood	12R1	5700	2/14	0	0.0		
LOWER COLORADO Bright Angel		8400	2/16	35	11.0		
GILA RIVER			0/17				
Inman Taylor Creek	7S2 7S1	7800 7850	2/15 2/15	6 4	2.0 0.7		

^{**}Average is for less than 15 years of record in the base period.



LIST OF SNOW SURVEYORS

SNOW COURSE	SURVEYOR
Baldy	SCS and SRVWUA
Bear Wallow	Forest Service - W. D. Nelson
Beaver Head	N. A. Josh
Bright Angel	National Park Service
Camp Wood	Mrs. C. C. Herritt
Canyon Creck #2	SCS and SRVWUA
Casner Park	SCS and SRVWUA
Chalender	Forest Service - M. C. Oleson
Coronado Trail	Forest Service - Bill Brainard
Forest Dale	Fort Apache Reservation - Valverde & Endfield
Frisco Divide	Forest Service - Frank Carroll
Ft. Apache	SCS and SRVWUA
Fort Valley	Rocky Mt. Forest & Range Experiment Station
Gaddes Canyon	SCS - Wm. Gray
Gentry	SCS and SRVWUA
Grand Canyon	National Park Service - Vincent Hefti
Happy Jack	Julius Brantley
Heber	SCS and SRVWUA
Inman	C. H. McCauley
Iron Springs	Ernest Saxby
McNary	Fort Apache Reservation - Valverde & Endfield
Maverick Fork	SCS and SRVWUA
Milk Ranch	Fort Apache Reservation - Valverde & Endfield
Mingus Mountain	SCS - Wm. Gray
Mogollon	J. R. Wray
Mormon Lake	SCS and SRVWUA
Mormon Mountain	SCS and SRVWUA
Munds Park	SCS and SRVWUA
Nutrioso	Forest Service - Bill Brainard
Pacheta	Foch Phillips
Rose Canyon	Forest Service - W. D. Nelson
State Line	Forest Service - Frank Carroll
Taylor Creek	C. H. McCauley
Willow Ranch	Tiny Miller
Workman Creek	Rocky Mt. Forest & Range Experiment Station



The Following Organizations Cooperate in the Arizona Snow Survey Work

FEDERAL

Deportment of Agriculture

Soil Conservation Service

Forest Service
Apoche Forest
Coconino Forest
Coronodo Forest
Gilo Forest
Koibab Forest
Prescott Forest

Rocky Mountoin Forest ond Ronge Experiment Station

Deportment of Commerce Weother Bureou Arizono Section

Department of Interior

Bureau of Reclomotion Region III

Geological Survey Arizano District

Bureou of Indion Affoirs.

Fort Apoche Reservotion

National Pork Service
Grand Conyon National Pork

Gila Woter Commissioner Sofford, Arizono

STATE

Arizono Agriculturol Experiment Stotion

IRRIGATION PROJECTS

Solt River Volley Woter Users' Association Phoenix, Arizono

Son Carlos Irrigation and Droinage District Coolidge, Arizono

PRIVATE

Southwest Lumber Mills, Inc. McNory, Arizono

Other organizations and individuals furnish valuable information for the snow survey reports. Their cooperation is gratefully acknowledged.

OFFICIAL BUSINESS

Federal - State - Private
COOPERATIVE SNOW SURVEYS

Furnishes the basic data necessary for forecasting water supply for irrigation, domestic and municipal water supply, hydro-electric power generation, navigation, mining and industry

"The Conservation of Water begins with the Snow Survey"